Experiments to determine the Difference in the Number of Vibrations made by an Invariable Pendulum in the Royal Observatory at Greenwich, and in the House in London in which Captain Kater's *Experiments were made. By Captain* Edward Sabine, *of the Royal Artillery, Sec. R.S. Communicated by the President and Council.* Read December 11, 1828. [*Phil. Trans.* 1829, *p.* 83.]

The experiments of which an account is given in this paper, were made in compliance with a request of the Council of the Royal Society, made in December 1827, that Captain Sabine would ascertain the difference in the number of vibrations of a pendulum at Mr. Browne's house, and at the Greenwich Observatory. The author gives a description of the instruments used in the observations; the first series of which were made in Mr. Browne's house, from the 17th to the 20th of March inclusive, and gave as the mean result, 85963·60 vibrations in a mean solar day. A reduction is here introduced, derived from some experiments made on the difference which takes place in the times of vibration in vacuo and in air; the number of vibrations in the former case being, under the same circumstances as in the observations, 9·97 *per diem* less than in the latter. A corresponding series made at Greenwich in May, gave as the mean 85964·17 vibrations, thus indicating an acceleration of 0·57 vibrations *per diem*; but the difference of latitude and of height between the two stations would have led us from theory to expect a total retardation of 0·38 vibration in the same time. From a second set of observations at Greenwich, the diurnal acceleration appeared to be 0·52 vibration. Taking the mean of this and the former result, it appears that the total amount of the discordance between theory and experiment is 0·91 vibration *per diem*. The stations are conveniently situated for verifying the existence of this anomaly, and its magnitude is such as to preclude all uncertainty as to its existence. With regard to its cause, the author is confirmed in the opinions he formerly entertained on this subject.

Tables are subjoined, containing accounts of the rate of the clocks used at both stations, and of the particulars of each series of observations.

On a definite Arrangement, and Order of the Appearance and Progress, of the Aurora Borealis; and on its Height above the Surface of the Earth. In a Letter to Davies Gilbert, *Esq. M.P. P.R.S. By the Rev.* James Farquharson, *Minister of the Parish of Allford, Aberdeenshire.* Read January 22, and February 29, 1829. [*Phil. Trans.* 1829, *p.* 103.]

The results of the numerous observations of the author on the Aurora Borealis, which on several occasions were made under very favourable circumstances, had already been announced in a short paper, published in 1823 in the Edinburgh Philosophical Journal; and it was concluded from them that the Aurora Borealis has in all cases a determinate arrangement and figure, and follows an invariable

order in its appearance and progress; that the pencils of rays or streamers, as they are called, generally make their first appearance in the north; and as they rise from the horizon, assume the form of an arch, extending from east to west, and having its vertex in the plane of the magnetic meridian, the arch itself being at right angles to that plane. While the arch itself is near the horizon, its breadth from north to south is considerable; and the streamers of which it is composed appear to be nearly at right angles to the general line of the arch, their directions converging to a point a few degrees to the south of the zenith. As the arch moves forwards towards the south, its lateral dimensions appear to contract, the intensity of its light increases, and the directions of the streamers, still tending to the same point in the heavens, approach more nearly to parallelism with that of the arch. When it has passed the zenith, and arrived at the above-mentioned point, a little to the south of the zenith, the arch is seen as a narrow belt, 3° or 4° only in breadth, and with well-defined edges. In its further progress southwards, it again enlarges in breadth, and exhibits, in a reverse order, the same succession of changes as before. Hence, the author concludes that the streamers have individually a position nearly vertical or parallel to the magnetic dip; that they form a thin fringe, stretching often to a great distance from east to west, at right angles to the magnetic meridian; and that the movement of the fringe from north to south takes place by the extinction of streamers at its northern side, and the formation of new ones contiguous to its southern side.

From a variety of observations which are detailed in this paper, the author infers, in opposition to the opinion of Mr. Dalton, that the region occupied by this meteor is above, but contiguous to, that of the clouds, or at least to that in which aqueous vapour is condensed, so as afterwards to appear in the form of clouds. The height of this region he estimates as in general about 2000 feet above the surface; and he is of opinion, that while such is the height of the lower ends of the vertical streamers, their upper ends may have an elevation of 2000 or 3000 feet more.

Observations on the Functions of the Intestinal Canal and Liver of the human Fœtus. *By* Robert Lee, *M.D., Physician to the British Lying-in-Hospital.* *Communicated by Dr.* Prout, *F.R.S.* Read June 19, 1828. [*Phil. Trans.* 1829, *p.* 121.]

From the circumstances of the early development of the liver and intestines in the fœtus, of the copious supply of blood which they receive, and of the great space which they occupy in the abdomen, the author was led to the conclusion that they performed some important functions in the fœtal economy. Although no nutritive matter can be furnished by the mouth, yet the contents of different portions of the alimentary canal were found, both in appearance and chemical composition, to bear a striking analogy to those of the same portions of the canal in the adult, where the processes of assimilation and ab-